

## M.Sc. Computer Science Syllabus First Year (2018-23)

### Network Programming

Semester I

Subject Code: MS11805

Lectures: 60

#### Objectives:

- The syllabus aims in equipping students with,
- Learning practical aspects of computer network programming, with emphasis on the Internet
  - Provide a strong foundation in sending and receiving data between processes in the UNIX and Internet domains
  - Provide an introduction to writing programs using the socket interface.
  - Provide an introduction to the TCP/IP client-server model of interaction, and to writing networking applications using the client/server technology, and an introduction to writing secure software.

#### Unit 1: Introduction to Networking and Sockets

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- A Simple Daytime Client
- Protocol Independence
- Error Handling: Wrapper Functions
- A Simple Daytime Server
- Socket
  - What is a Socket?
  - Socket Address Structures
  - Value-Result Arguments
  - Byte Ordering Functions
  - Byte Manipulation Functions
  - inet\_aton, inet\_addr, and inet\_ntoa Functions, inet\_pton and inet\_ntop Functions, sock\_ntop and Related Functions, readn, writen, and readln Functions, isfdtype Function
- Elementary TCP Sockets
  - socket Function, connect Function, bind Function, listen Function, accept Function, fork and exec Functions, Concurrent Servers, close Function, getsockname and getpeername Functions

#### BOS Members:

Ms. Seema Chowhan (Subject Expert)

Prof. M.B. Lonare (Subject Expert)

Ms. Shilpa Khadilkar (Subject Expert)

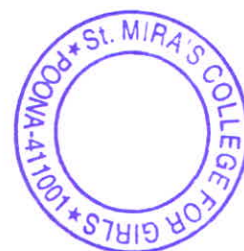
Ms Anuradha Bhamre (Industry Expert)

Ms Aishwarya Kaliyiluvila (Alumni)

Prof. Ashwini Kulkarni (Chairman)

Prof. Smita Borkar (Internal Faculty)

Prof. Swati Pulate (Internal Faculty)



**Unit 2: TCP Client-Server Example**

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- Introduction
- TCP Echo Server: main Function
- TCP Echo Server: str\_echo Function
- TCP Echo Client: main Function
- TCP Echo Client: str\_cli Function
- Normal Startup
- Normal Termination
- Connection Abort before accept Returns
- Termination of Server Process
- SIGPIPE Signal
- Crashing of Server Host
- Crashing and Rebooting of Server Host
- Shutdown of Server Host

**Unit 3: I/O Multiplexing**

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- Introduction
- I/O Models(blocking, non blocking,I/O multiplexing, Signal driven, Asynchronous), Comparison
- select Function
- str\_cli Function (Revisited)
- Batch Input
- shutdown Function
- str\_cli Function (Revisited Again)
- TCP Echo Server (Revisited)
- pselect Function
- poll Function
- TCP Echo Server (Revisited Again)

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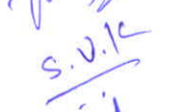

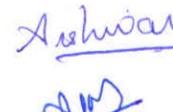




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<b>Unit 4: Socket Option and Elementary UDP Socket</b>	<b>12</b>
<ul style="list-style-type: none"> <li>• getsockopt and setsockopt Functions</li> <li>• Checking If an Option Is Supported and Obtaining the Default</li> <li>• Socket States</li> <li>• Generic Socket Options</li> <li>• IPv4 Socket Options</li> <li>• ICMPv6 Socket Option</li> <li>• IPv6 Socket Options</li> <li>• TCP Socket Options</li> <li>• Elementary UDP Sockets <ul style="list-style-type: none"> <li>➤ recvfrom and sendto Functions</li> <li>➤ UDP Echo Server: main Function</li> <li>➤ UDP Echo Server: dg_echo Function</li> <li>➤ UDP Echo Client: main Function</li> <li>➤ UDP Echo Client: dg_cli Function</li> <li>➤ Lost Datagrams</li> <li>➤ Verifying Received Response</li> <li>➤ Server Not Running</li> <li>➤ Summary of UDP example</li> <li>➤ connect Function with UDP</li> <li>➤ dg_cli Function (Revisited)</li> <li>➤ Lack of Flow Control with UDP</li> <li>➤ Determining Outgoing Interface with UDP, TCP and UDP Echo Server Using select</li> <li>➤ User Datagram Protocol</li> <li>➤ File Transfer</li> <li>➤ Error Handling</li> </ul> </li> </ul>	
<b>Unit 5: Protocols</b>	<b>4</b>
<ul style="list-style-type: none"> <li>• State vs. Stateless</li> <li>• Methods for Maintaining State</li> <li>• What Is a Protocol?</li> <li>• Designing a Custom Protocol</li> <li>• Our Chat Protocol</li> <li>• Protocol Registration</li> </ul>	

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**Unit 6: Elementary Name, Address Conversions and design decisions****8**

- Domain Name System
- gethostbyname Function
- RES\_USE\_INET6 Resolver Option
- gethostbyname2 Function and IPv6 Support
- gethostbyaddr Function
- uname Function
- gethostname Function
- getservbyname and getservbyport Functions
- TCP vs. UDP
- Application Protocol Choices
- Client-Server Architecture
- Client-Side Considerations
- Server-Side Considerations

**\*Contact hours – 12 hours****Reference Books:**

1. W. Richard Stevens, Bill Fenner, Andrew M. Rudoff, PHI, *Unix Network Programming, Volume 1: The Sockets Networking API*, 3<sup>rd</sup> Edition
2. KEIR DAVIS, JOHN W. TURNER, AND NATHAN YOCOM, Apress, *The Definitive Guide to Linux Network Programming*

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